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Entanglement Studies, St. Paul Island, 1988

Juvenile Male Roundups

February 1989

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ENTANGLEMENT STUDIES, ST PAUL ISLAND, 1988
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JUVENILE MALE ROUNDUPS

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February, 1989

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ENTANGLEMENT STUDIES, ST PAUL ISLAND, 1988
- JUVENILE MALE ROUNDUPS[1]

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Recent studies of northern fur seals (Callorhinus ursinus) have included efforts to determine the effects of entanglement in marine debris. Juvenile males (aged 2 to 5 years) comprise the component of the population most readily studied in this regard. Entanglement among these males is studied during roundups wherein animals are grouped together on or near haul-out areas adjacent to breeding rookeries. A total of 66 roundups were completed during studies on St. Paul Island during July of 1988 (Table 1).

During such studies conducted in 1988, 24,519 male seals of the size historically taken in the commercial harvest (roughly 105 to 125 cm in total length) were examined for debris. (Unless indicated otherwise, data in this report apply to seals of this size.) Among these, the entangled animals were counted to estimate the entanglement rate for comparison with rates observed in the commercial harvest prior to 1985. All but one of 53 entangled subadult male seals were captured and tagged with blue numbered Allflex tags bearing the address of the National Marine Mammal Laboratory (Table 2). Tags were placed on the inner trailing edge of the front flipper, near the hairline, according

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[1]Research reported herein was partially funded by the National Marine Fisheries Service Marine Entanglement Research Program, James Coe, Program Manager.

to standard practice for this species. For each entangled seal, two controls were also tagged to compare rates of return in succeeding years (Table 2). This resulted in the tagging of 104 similarly sized seals with no debris entangling them in addition to the entangled animals that were tagged.

Thirty juvenile male seals were instrumented with radio tags to study the effects of entanglement on patterns of hauling out on land. Specifically, this part of the 1988 entanglement research was carried out to examine the probability of being on land as it might be affected by entanglement to evaluate data on the relative occurance of entangled versus unentangled seals. Additionally, two juvenile males were instrumented with imitation satellite tags and radios as a feasibility test for the application of equipment of similar size in future fur seal research. The data and results from these studies will be reported elsewhere.

All seals, regardless of size, were examined for tags during roundups. As shown in Table 3, seals tagged in previous years were resighted along with seals tagged during the 1988 season. As in previous years, some of the resighted seals were seen on more than one occasion during the 1988 season. Of the resighted tagged seals for which the tags were read, 60 were from the application of Allflex tags in 1985 and 1986 during earlier phases of research to evaluate the mortality of young male seals in small debris. Fifty-three of these were seals tagged earlier as controls and 7 were entangled when tagged in previous years.

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One entangled seal that had been tagged as an entangled animal in 1984 was also resighted. Of the total of 8 seals resighted after having been tagged as entangled, 6 had lost their entangling debris. All debris that was lost had been noted at its first sighting as being small but was otherwise similar to commonly observed debris. Ten additional tags from previous years (9 orange Allflex and 1 Roto tag that appeared to be white) were sighted but not read; none of these animals were entangled at the time of the resighting.

Fifty-three entangled juvenile male seals of harvestable size encountered in the roundups were examined to determine the nature of the entangling debris. Information noted included: the size and kind of the debris, the extent of any wounds, and how tightly the debris was lodged on the animal were noted (Table 4). One seal was so badly wounded by its entangling debris that it was bleeding profusely and was not expected to live long. The debris was removed from this animal, which, in turn, was released without applying tags. (This animal was resighted later in the season, alive, but continuing to show signs of severe debilitation caused by the wound.) The remainder were tagged as indicated in Tables 2 and 4.

Of the entangled harvestable sized seals examined (53), 27(50.9%) carried fragments of trawl webbing, 14(26.4%) plastic packing bands and 10(18.9%) string, small line or cords. The overall entanglement rate is estimated by the ratio of all (both initial and all subsequent) entanglement sightings to the total

number of seals examined (thus including the resightings in both cases, i.e. a sampling with replacement design). The entanglement rate for 1988 was 0.285% (70/24519, Table 1). This rate of entanglement is less than the observed rate of 0.4% between 1976 and 1985. Table 5 shows that the majority of the reduction can be attributed to a reduction in the rate of entanglement in trawl webbing. Historically the rate of entanglement in trawl webbing has been about 0.27%, whereas in 1988 that rate dropped to about 0.15%, a reduction to about 56% of earlier levels.

Table 6 shows the record of tags applied to juvenile males during entanglement studies for each year since 1985. Of 257 seals tagged in 1985, 85 (33%) were entangled animals. Of the tags released in 1985 and recovered in 1986 (49), 12 (24%) were originally tagged as entangled animals. This change is not statistically significant (Chi-squared test, $p<0.5$). There was no field effort in 1987 so no samples were collected in that year. Of the 14 seals tagged in 1985 and resighted in 1988, 1 (7%) had been tagged as entangled. In this case, the change in ratio from 0.33 to 0.07 is statistically significant (binomial probability tests, $p<0.05$). Of the 407 animals tagged in 1986, 128 (31.4%) were entangled. Of 46 seals tagged in 1986 and resighted in 1988, 6 (13%) were tagged as entangled seals in 1986. This is also a statistically significant change (Chi-squared test, $p<0.05$). A total of 192 tagged seals were released in 1988 to be resighted in 1989. Changes in the ratios, as

reported above, relate to the additional mortality suffered by entangled animals but may also be influenced by any difference in the probability of being resighted. The analysis of these data with the estimated rates of survival due to entanglement will be presented elsewhere.

In summary, the 1988 results of entanglement research through roundups of juvenile males showed:

1) A reduction of the entanglement rate from about 0.4% to 0.29%.
2) Entanglement in trawl webbing in 1988 was about half of entanglement levels observed for this kind of debris in previous years.
3) The rate of resighting for animals tagged in 1985 and resighted in 1988 showed that entangled animals tagged in that year were seen at a rate that was significantly less than the rate at which controls were resighted.
4) The rate of resighting for animals tagged in 1986 and resighted in 1988 showed that entangled animals tagged in that year were seen at a rate that was significantly less than the rate at which controls were resighted.

Further future analyses will involve the data in this report in combination with the data obtained from radio tagging studies conducted in 1988. This work will examine the rates of occurance on land (i.e. the probability of being included in the roundups)

of animals tagged as entangled or control animals during the same season in continuing efforts to provide estimated rates of mortality due to entanglement.

Table 1. Summary of roundups of juvenile (subadult) males conducted on St. Paul Island, Alaska, during July of 1988.

Date (July)	Location	Total[1] in Roundup	Tagged Seals[2] Resighted	Entangled Seals[3] Seen	Total Seals Tagged
16	Zapadni Reef	44	0	0	0
16	Zapadni Reef	45	2	0	0
16	Zapadni Reef Sands	379	2	1	3
16	Zapadni	335	3	3	9
17	Reef	349	3	3	9
17	Reef	401	2	2	4
17	Reef	267	1	0	0
18	Kitovi	271	0	1	3
18	Tolstoi	520	2	0	0
18	Tolstoi Sands	590	3	2	3
18	Zoltoi Sands	1019	11	3	3
19	Gorbatch	904	3	1[4]	8
19	Reef	451	5	1	3
20	Northeast Point West	158	0	0[5]	0
20	Northeast Point West	374	1	4	1
20	Northeast Point West	625	0	2	5
20	Northeast Point West	174	0	2	7
21	Little Zapadni	639	0	0	1
21	Zapadni	1176	7	2	4
21	Zapadni	170	1	0	0
22	Lukanin	273	0	0	0
22	Polovina	403	0	2	6
22	Polovina	556	1	0	0
23	Northeast Point West	307	2	1	0
23	Northeast Point West	294	0	0	0
23	Northeast Point West	276	0	1	3
23	Northeast Point West	198	2	0	0
24	Reef	100	0	0	2
24	Zapadni	331	1	0	0
24	Zapadni	394	0	0	0
24	Zapadni Reef Sands	439	4	2	3
25	Tolstoi	549	3	1	3
25	Tolstoi	578	4	3	3
25	Zapadni Reef	137	0	1	3
25	Zapadni Reef	133	3	0	0
26	Kitovi	372	1	2	6
26	Northeast Point East	511	5	1	0
26	Northeast Point East	649	7	3	6
26	Reef	285	1	2	6
28	Little Zapadni	515	5	1	0
28	Lukanin	337	1	0	0
28	Polovina	270	3	1	0
28	Polovina	525	2	2	3

Table 1. (continued)

Date (July)	Location	Total in[1] Roundup	Tagged Seals[2] Resighted	Entangled Seals[3] Seen	Total Seals Tagged
29	Northeast Point	276	3	2	6
29	Northeast Point West	183	0	2	6
29	Northeast Point West	248	1	2	6
29	Northeast Point West	55	1	0	0
29	Northeast Point West	285	5	2	0
29	Northeast Point West	121	1	0	0
29	Northeast Point West	234	2	0	0
29	Northeast Point West	354	1	1	3
29	Northeast Point West	200	1	2	6
30	Zapadni	302	2	2	2
30	Zapadni	129	1	0	4
30	Zapadni	190	1	1	3
30	Zapadni	81	2	1	0
30	Zapadni	627	6	0	0
30	Zapadni	84	0	0	0
30	Zapadni	660	0	0	0
30	Zapadni Reef	38	1	0	0
30	Zapadni Reef	1253	2	0	0
30	Zapadni Reef	44	4	0	0
31	Gorbatch	259	3	2	3
31	Kitovi	366	1	0[6]	3
31	Tolstoi	963	2	3	6
31	Tolstoi	274	0	1	3
Totals		24519	131	70	158

[1]Seals that are of the size that were taken in the commercial harvest prior to 1985.

[2]Seals which had any kind of tag in either fore-flipper and that were successfully restrained to read the tag. Includes any that were resighted more than once this year.

[3]Entangled seals seen, regardless of whether or not they had been seen before (i.e. tagged or not).

[4]Seal with tag number 43 was taken independent of roundups. It can not be used to calculate entanglement rates and is not included in this table.

[5]An entangled male too large to count was seen in this roundup.

[6]An entangled female was found in this roundup but not counted.

Table 2. List of blue Allflex tags applied to northern fur seals during roundups conducted on St. Paul Island, Alaska, 1988.

Tag Number	Date (July)	Sex	Location	Entangled (e) Control (c)	Notes
1	16	m	Zapadni Reef Sands	e	
2	16	m	Zapadni Reef Sands	c	
3	16	m	Zapadni Reef Sands	c	
4	16	m	Zapadni	e	
5	16	m	Zapadni	e	
6	16	m	Zapadni	c	
7	16	m	Zapadni	c	
8	16	m	Zapadni	c	
9	16	m	Zapadni	c	
10	16	m	Zapadni	e	
11	16	m	Zapadni	c	
12	16	m	Zapadni	c	
13	17	m	Reef	e	
14	17	m	Reef	e	Radio tagged
15	17	m	Reef	c	
16	17	m	Reef	c	
17	17	m	Reef	c	
18	17	m	Reef	e	Radio tagged
19	17	m	Reef	e	Radio tagged
20	17	m	Reef	e	Radio tagged
21	17	m	Reef	c	Radio tagged
22	17	m	Reef	c	
23	17	m	Reef	c	Radio tagged
24	17	m	Reef	c	
25	17	m	Reef	c	
26	17	m	Reef	c	Radio tagged
27	18	m	Tolstoi	e	
28	18	m	Tolstoi	c	
29	18	m	Tolstoi	c	
30	18	m	Kitovi	e	Radio tagged
31	18	m	Kitovi	c	
32	18	m	Kitovi	c	Radio tagged
33	18	m	Zoltoi Sands	e	Radio tagged
34	18	m	Zoltoi Sands	c	
35	18	m	Zoltoi Sands	c	Radio tagged
36	19	m	Gorbatch	e	Radio tagged
37	19	m	Gorbatch	c	
38	19	m	Gorbatch	c	Died
39	19	m	Gorbatch	c	Radio tagged
40	19	m	Gorbatch	c	
41	19	m	Gorbatch	c	Radio tagged
42	19	m	Gorbatch		Imitation satellite tag

Table 2. (continued)

Tag Number	Date (July)	Sex	Location	Entangled (e) Control (c)	Notes
43	19	m	Gorbatch	e	
44	19	m	Reef		Imitation satellite tag
45	19	m	Reef	c	
46	19	m	Reef	c	
47	20	m	Northeast Point West	e	
48	20	m	Northeast Point	c	
49	20	m	Northeast Point	e	Radio tagged
50	20	m	Northeast Point	c	Radio tagged
51	20	m	Northeast Point	e	Radio tagged
52	20	m	Northeast Point	c	
53	20	m	Northeast Point West	e	Radio tagged
54	20	m	Northeast Point West	c	Radio tagged
55	20	m	Northeast Point West	c	
56	20	m	Northeast Point West	e	
57	20	m	Northeast Point West	c	
58	20	m	Northeast Point West	c	
59	20	m	Northeast Point West	c	Radio tagged
60	21	m	Little Zapadni	c	Radio tagged
61	21	m	Zapadni	e	
62	21	m	Zapadni	e	Radio tagged
63	21	m	Zapadni	c	
64	21	m	Zapadni	c	Radio tagged
65	22	m	Polovina	e	Radio tagged
66	22	m	Polovina	e	Radio tagged
67	22	m	Polovina	c	
68	22	m	Polovina	c	Radio tagged
69	22	m	Polovina	c	
70	22	m	Polovina	c	Radio tagged
71	23	m	Northeast Point West	e	
72	23	m	Northeast Point West	c	
73	23	m	Northeast Point West	c	
74	24	m	Zapadni Reef	e	
75	24	m	Zapadni Reef	c	
76	24	m	Zapadni Reef	c	
77	24	m	Reef	c	
78	24	m	Reef	c	Radio tagged
79	25	m	Tolstoi	e	
80	25	m	Tolstoi	c	
81	25	m	Tolstoi	c	
82	25	m	Tolstoi	e	
83	25	m	Tolstoi	c	
84	25	m	Tolstoi	c	
85	25	m	Zapadni Reef	e	
86	25	m	Zapadni Reef	c	
87	25	m	Tolstoi	c	
88	26	m	Kitovi	e	
89	26	m	Kitovi	e	

Table 2. (continued)

Tag Number	Date (July)	Sex	Location	Entangled (e) Control (c)	Notes
90	26	m	Kitovi	c	
91	26	m	Kitovi	c	
92	26	m	Kitovi	c	
93	26	m	Kitovi	c	
94	26	m	Northeast Point	c	
95	26	m	Northeast Point	c	
96	26	m	Northeast Point East	e	
97	26	m	Northeast Point East	e	
98	26	m	Northeast Point East	c	
99	26	m	Northeast Point East	c	
100	26	m	Reef	e	
101	26	m	Reef	c	
102	26	m	Reef	c	
103	26	m	Reef	e	Radio tagged
104	26	m	Reef	c	
105	26	m	Reef	c	Radio tagged
106	27	f	Zapadni Reef		Footnote 1
107	27	f	Zapadni Reef		Footnote 1
108	28	m	Polovina	c	
109	28	m	Polovina	c	
110	28	m	Polovina	e	
111	29	m	Northeast Point	e	
112	29	m	Northeast Point	c	
113	29	m	Northeast Point	c	
114	29	m	Northeast Point	e	
115	29	m	Northeast Point	c	
116	29	m	Northeast Point	c	
117	29	m	Northeast Point West	e	
118	29	m	Northeast Point West	e	
119	29	m	Northeast Point West	c	
120	29	m	Northeast Point West	c	
121	29	m	Northeast Point West	c	
122	29	m	Northeast Point West	c	
123	29	m	Northeast Point West	e	
124	29	m	Northeast Point West	c	
125	29	m	Northeast Point West	c	
126	29	m	Northeast Point West	e	
127	29	m	Northeast Point West	c	
128	29	m	Northeast Point West	c	
129	29	m	Northeast Point West	e	
130	29	m	Northeast Point West	c	
131	29	m	Northeast Point West	c	
132	29	m	Northeast Point West	c	

Table 2. (continued)

Tag Number	Date (July)	Sex	Location	Entangled (e) Control (c)	Notes
133	29	m	Northeast Point West	c	
134	29	m	Northeast Point West	e	
135	29	m	Northeast Point West	c	Footnote 2
136	29	m	Northeast Point West	e	Footnote 3
137	29	m	Northeast Point West	c	
138	30	m	Zapadni	e	
139	30	m	Zapadni	e	
140	30	m	Zapadni	c	
141	30	m	Zapadni	c	
142	30	m	Zapadni	c	
143	30	m	Zapadni	c	
144	30	m	Zapadni	e	
145	30	m	Zapadni	c	
146	30	m	Zapadni	c	
147	31	m	Tolstoi	e	
148	31	m	Tolstoi	c	
149	31	m	Tolstoi	c	
150	31	m	Tolstoi	e	
151	31	m	Tolstoi	e	
152	31	m	Tolstoi	c	
153	31	m	Tolstoi	c	
154	31	m	Tolstoi	c	
155	31	m	Tolstoi	c	
156	31	f	Kitovi	e	Debris removed
157	31	m	Kitovi	e	
158	31	m	Kitovi	c	
159	31	m	Kitovi	c	
160	31	m	Gorbatch	e	
161	31	m	Kitovi	c	
162	31	m	Kitovi	c	

[1]This tag was applied to a female at Zapadni Reef on July 27. This female was used to attach a transmitter and power pack for Japanese research on feeding and diving.

[2]The left flipper of this animal is tagged 135 top and bottom. The right flipper is tagged 135 top and 136 bottom.

[3]The right flipper of this animal has tag number 135 on the bottom side.

Table 3. List of tagged fur seals seen during July juvenile male roundup activities on St. Paul Island, 1988. Tags were seen on both fore-flippers unless noted otherwise.

Date (July)	Location	Tag Number	Tag Color	Tag Type	entangled=e[1] control=c	Notes
16	Zapadni Reef	879	blue	Roto		Hole noted in left flipper.
16	Zapadni Reef	5157	white	Allflex		Tagged on Aug. 3, 1986 as and entangled animal at Polovina, with gray rope tight around its neck.
16	Zapadni Reef	0234	orange	Allflex	c	Tagged Aug. 10, 1985 at Northeast Point.
16	Zapadni Reef	0478	orange	Allflex	c	Tagged on Aug. 24, 1986 at Zapadni. Right flipper had tag number 0479.
16	Zapadni	0401	orange	Allflex	c	Tagged on July 25, 1986 at Zapadni.
16	Zapadni	0109	orange	Allflex		Tagged on July 29, 1985 at Reef as an entangled animal with white chord on it.
16	Zapadni	0756	orange	Allflex	c	Tagged on Aug. 25, 1986 at Polovina. Right flipper had tag number 0757 .
17	Reef	MC1488	monel	monel		No tag read in right flipper.
17	Reef	0382	orange	Allflex	c	Tagged on July 23, 1986 at Gorbatch. No tag read in right flipper.
17	Reef	0460	orange	Allflex	c	Tagged on Aug. 24, 1986 at Zapadni.
17	Reef	5127	white	Allflex	c	Tagged on Aug 1, 1986 at Gorbatch.
17	Reef	5174	white	Allflex	c	Tagged on Aug. 4, 1986 at Tolstoi.
17	Reef	5174	white	Allflex	c	Sighted earlier in previous roundup.
18	Tolstoi	5	blue	Allflex	e	Same entanglement as when tagged.
18	Tolstoi	8	blue	Allflex	c	Tagged on at Zapadni on July 16.
18	Tolstoi	0034	orange	Allflex	c	Tagged on 12 July, 1985 at Northeast Point.
18	Tolstoi	0191	orange	Allflex	c	Tag read on left only, but tags present on both sides. Tagged on 7 Aug. 1985, at Tolstoi.
18	Tolstoi	5178	white	Allflex	c	Tagged on Aug. 3, 1986 at Tolstoi.
18	Zoltoi Sands	18	blue	Allflex	e	Debris and radio same as when tagged.
18	Zoltoi Sands	20	blue	Allflex	e	Debris and radio same as when tagged.
18	Zoltoi Sands	9	blue	Allflex	c	Tagged on July 16 at Zapadni Sands.

Table 3. (continued)

Date (July)	Location	Tag Number	Tag Color	Tag Type	entangled=e[1] control=c	Notes
18	Zoltoi Sands	15	blue	Allflex	c	Tagged on July 17 at Reef.
18	Zoltoi Sands	0073	orange	Allflex	c	Tagged on 20 July, 1985 at Tolstoi.
18	Zoltoi Sands	0380	orange	Allflex	c	Tagged on July 23, 1986 at Gorbatch.
18	Zoltoi Sands	0383	orange	Allflex	c	Tagged on July 23, 1986 at Gorbatch.
18	Zoltoi Sands	0478	orange	Allflex	c	Tagged on Aug. 24, 1986 at Zapadni. Tag number 0479 in right flipper.
18	Zoltoi Sands	0602	orange	Allflex	c	Tagged during August, 1986 at Zapadni.
18	Zoltoi Sands	0702	orange	Allflex	c	Tagged on August 24, 1986 at Reef. Tag number 0703 on right flipper.
19	Reef	16	blue	Allflex		Assumed to be male, exhibited some female behavior.
19	Reef	1	blue	Allflex	e	Debris same as when tagged.
19	Reef	0234	orange	Allflex	c	See previous sighting this year.
19	Reef	0456	orange	Allflex	c	Tagged on Aug. 24, 1986 at Reef. Tag number 0457 on right flipper.
19	Gorbatch	412	yellow	Roto		Footnote 2
19	Gorbatch	9	blue	Allflex	c	
19	Gorbatch	22	blue	Allflex	c	
20	Vostochni	0718	orange	Allflex	c	Tagged on Aug. 24, 1986 at Vostoshni. Tag number 0719 on right flipper.
21	Zapadni	bE608	monel	monel		
21	Zapadni	0481	orange	Allflex	c	Tagged on Aug 24, 1986, at Zapadni. No tag read in left flipper.
21	Zapadni	6	blue	Allflex	c	
21	Zapadni	8	blue	Allflex	c	
21	Zapadni	12	blue	Allflex	c	
21	Zapadni	25	blue	Allflex	c	
21	Zapadni	37	blue	Allflex	c	
21	Zapadni	0964	orange	Allflex	c	Tagged on Oct. 11, 1986 at Zapadni. Right flipper had tag number 0965.

Table 3. (continued)

Date (July)	Location	Tag Number	Tag Color	Tag Type	entangled=e[1] control=c	Notes
21	Zapadni	0966	orange	Allflex	c	Tagged on Oct. 11, 1986 at Zapadni. No tag read in right flipper.
23	Vostochni	825	pink	Roto		Tag may have been a different color originally. No tag read in left flipper.
23	Vostochni	0444	orange	Allflex	c	Tagged on July 31, 1986 at Vostochni. No tag read in left flipper.
23	Vostochni	54	blue	Allflex	c	Radio intact.
23	Vostochni	57	blue	Allflex	c	
24	Zapadni Reef	14	blue	Allflex	e	Debris and tags same as when tagged earlier.
24	Zapadni Reef	0478	orange	Allflex	c	Seen twice earlier this year. Tag number 0479 in left flipper.
24	Zapadni	60	blue	Allflex	c	Radio intact.
24	Zapadni	70	blue	Allflex	c	Radio intact.
24	Zapadni	0712	orange	Allflex	c	Tagged on 24 Aug, 1986 at Vostoshni. Tag number 0713 in left flipper.
25	Tolstoi	62	blue	Allflex	e	Debris, and radio as when originally tagged.
25	Tolstoi	5193	white	Allflex	e	Tagged on Aug. 5, 1986 at Vostoshni with a 30 degree wound.
25	Tolstoi	0034	orange	Allflex	c	Tagged on 12 July, 1985 at Northeast Point.
25	Tolstoi	0225	orange	Allflex	c	Tagged on Aug. 9, 1985 at Lukanin.
25	Tolstoi	0358	orange	Allflex	c	Tagged on July 22, 1986 at Zoltoi Sands.
25	Tolstoi	0702	orange	Allflex	c	Tagged on 24 Aug., 1986 at Reef. Left flipper had tag number 0703.
25	Tolstoi	5112	white	Allflex	c	Tagged on Oct. 15, 1986 at Little Zapadni.
25	Zapadni Reef	0025	orange	Allflex	c	Tagged on July 11, 1985 at Zapadni.

Table 3. (continued)

Date (July)	Location	Tag Number	Tag Color	Tag Type	entangled=e[1] control=c	Notes
25	Zapadni Reef	0994	orange	Allflex	c	Tagged on Oct. 12, 1986 at English Bay. Left flipper had tag number 0995.
25	Zapadni Reef	5153	white	Allflex	c	Tagged on Aug. 2, 1986 at Zapadni Reef.
26	Morjovi	412	yellow	Roto		
26	Morjovi	bC2249	monel	monel		No tag in right flipper.
26	Morjovi	MA3307	monel	monel		
26	Morjovi	ME263	monel	monel		
26	Morjovi	ME3119	monel	monel		Hole in right flipper.
26	Morjovi	bE2376	monel	monel		Tag scar in left flipper.
26	Morjovi	49	blue	Allflex	e	Debris same as when tagged. Radio had slight bend in its antenna.
26	Morjovi	56	blue	Allflex	e	Debris and radio same as when tagged.
26	Morjovi	5161	white	Allflex	c	Tagged on Aug. 31, 1986 at Polovina. Left flipper not examined.
26	Morjovi	59	blue	Allflex	c	Radio intact.
26	Morjovi	0089	orange	Allflex	c	Tagged on July 24, 1985 at Morjovi.
26	Morjovi	5115	white	Allflex	c	Tagged on Oct. 16, 1986 at Polovina.
26	Kitovi	0082	orange	Allflex	c	Tagged on July 23, 1985 at Gorbatch.
26	Reef	93	blue	Allflex	c	Tagged earlier in day at Kitovi.
28	Polovina	2054	pink	Roto		Left flipper not examined.
28	Polovina	30	blue	Allflex	e	Debris and radio as when first tagged.
28	Polovina	66	blue	Allflex	e	Debris, and radio as when tagged.
28	Polovina	69	blue	Allflex	c	
28	Polovina	0343	orange	Allflex	c	Tagged on July 22, 1986 at Polovina.
28	Little Zapadni	61	blue	Allflex	e	Debris as when tagged.
28	Little Zapadni	29	blue	Allflex	c	
28	Little Zapadni	0135	orange	Allflex	c	Tagged on July 30, 1985 at Tolstoi.
28	Little Zapadni	5139	white	Allflex	c	Tagged on Aug. 1, 1986 at Zapadni.
28	Little Zapadni	5143	white	Allflex	c	Tagged on Aug. 1, 1986 at Zapadni.

Table 3. (continued)

Date (July)	Location	Tag Number	Tag Color	Tag Type	entangled=e[1] control=c	Notes
28	Lukanin	92	blue	Allflex	c	
29	Vostochni	0042	orange	Allflex		Tagged on July 15, 1985 at Zapadni as a netmarked animal.
29	Vostochni	0332	orange	Allflex		Tagged as an entangled animal July 20, 1986 at Vostoshni. It had been entangled in a small piece of green trawl webbing.
29	Vostochni	5151	white	Allflex		Tagged on Aug 1, 1986 as an entangled animal at Zapadni. It had been entangled in a blue packing band.
29	Vostochni	5366	yellow	Riese		Tag scar on right flipper.
29	Vostochni	544	blue	Roto		The tag on the left flipper of this animal was broken. This animal was originally tagged on July 17, 1984 at Polovina with a small piece of gray trawl webbing on its neck with a 90 degree wound and only one mesh around its neck.
29	Vostochni	ME137	monel	monel		
29	Vostochni	ME971	monel	monel		Side of tag not noted, whether or not both tags present not noted.
29	Northeast Point	bE2376	monel	monel		Tag scar on left.
29	Vostochni	71	blue	Allflex	e	Debris as when tagged.
29	Vostochni	114	blue	Allflex	e	Debris as when tagged.
29	Vostochni	0420	orange	Allflex	c	Tagged on July 27, 1986 at Little Zapadni.
29	Northeast Point	0716	orange	Allflex	c	Tag hole on right. Tagged on Aug 24, 1986 at Vostoshni.
29	Vostochni	0718	orange	Allflex	c	Tag number 0719 on right. Already sighted once this year.
29	Northeast Point	0958	orange	Allflex	c	Tag number 0959 on right. Tagged on Oct 8, 1986 at Morjovi.
29	Vostochni	0986	orange	Allflex	c	Tag number 0987 on right. Tagged on Oct. 12, 1986 at English Bay.

Table 3. (continued)

Date (July)	Location	Tag Number	Tag Color	Tag Type	entangled=e[1] control=c	Notes
30	Zapadni Reef	0060	orange	Allflex	c	Tag read on right only. Tag number was originally read as 0900. Since this number was not applied it is being assumed that it is actually 0060. This tag was applied to a control on July 18, 1985 at Polovina.
30	Zapadni Reef	831	pink	Roto		Tag was seen on one side only and the side on which it was seen was not noted.
30	Zapadni Reef	bE608	monel	monel		Scar on right.
30	Zapadni Reef	0404	orange	Allflex	c	Tagged on July 25, 1986 at Zapadni. Only one tag read not verified for both sides.
30	Zapadni Reef	0466	orange	Allflex	c	Tag number 0467 in right flipper. Tagged on Aug. 24, 1986 at Zapadni.
30	Zapadni Reef	0994	orange	Allflex	c	Tag number 0995 in right flipper. Seen previously in this season.
30	Zapadni	0394	orange	Allflex		Tagged as an entangled animal on July 25, 1986, at Zapadni. It had been loosly entangled in a piece of sheet plastic.
30	Zapadni	ME248	monel	monel		
30	Zapadni	85	blue	Allflex	e	Debris as when first tagged.
30	Zapadni	0052	orange	Allflex	c	Tagged on July 16, 1985 at Gorbatch.
30	Zapadni	0245	orange	Allflex	c	Tagged on Aug. 10, 1985 at NEP West.
30	Zapadni	0401	orange	Allflex	c	Same as seen in earlier roundup same day.
30	Zapadni	0401	orange	Allflex	c	Seen earlier this year.
30	Zapadni	0464	orange	Allflex	c	Tag number 0465 in right flipper. Tagged on Aug. 24, 1986 at Zapadni.
30	Zapadni	0964	orange	Allflex	c	Tag number 0965 in right flipper. Same as when seen in earlier roundup.

Table 3. (continued)

Date (July)	Location	Tag Number	Tag Color	Tag Type	entangled=e[1] control=c	Notes
30	Zapadni	0998	orange	Allflex	c	Hole in right flipper. Tagged on Oct. 14, 1986 at Polovina Cliffs.
30	Zapadni	5138	white	Allflex	c	Tagged on Aug. 1, 1986 at Zapadni.
30	Zapadni	5141	white	Allflex	c	Tagged on Aug. 1, 1986 at Zapadni.
31	Tolstoi	61	blue	Allflex	e	As when tagged.
31	Tolstoi	84	blue	Allflex	c	
31	Kitovi	0094	orange	Allflex	c	Tagged on July 24, 1985 at NEP East.
31	Gorbatch	0352	orange	Allflex	e	Seen in right flipper only. Tagged on July 22, 1986 at Zoltoi Sands.
31	Gorbatch	101	blue	Allflex	c	
31	Gorbatch	0908	orange	Allflex	c	Tag number 0909 in right flipper. Tagged on Oct. 6, 1986 at Tolstoi.

[1]State of the animal at time of resighting. No animals tagged as controls were resighted as entangled. Animals not part of the entanglement study are not designated as controls; whereas any entangled animals is so noted.

[2]It is possible that this is an animal tagged in 1983 as an entangled animal. If so, it was originally tagged with a blue roto tag. A seal was tagged on "Reef" (which may have been a term including Gorbatch since the Reef harvests were usually of animals driven from several locations on the point) on July 8, 1983 with gray trawl net loosly entangling its neck.

Table 4. List of juvenile male fur seals tagged as entangled animals during surveys conducted in July of 1988, St. Paul Island, Alaska, showing the nature of the debris on each animal.

Tag Number	Date	Location	Description of Debris						
			Type	Size	Color	Tightness	Wound	Mesh Size	Twine Size
1	July 16	Zapadni Reef	trawl	s	orange	vt	360	20.0cm	
4	" 16	Zapadni	rubber band	s	black	t	0		
5	" 16	Zapadni	packing band	s	white	t	0		
10	" 16	Zapadni	packing band	s	white	l	0		
13	" 17	Reef	trawl	s	green	t	180	16.0cm	3.5mm
14	" 17	Reef	trawl	s	green	vt	300		
18	" 17	Reef	trawl	s	grey	l	0		
19	" 17	Reef	packing band	s	white	t	360		
20	" 17	Reef	trawl	m	grey	t	0	21.5cm	3.0mm
27	" 18	Tolstoi	packing band	s	blue	l	0		
30	" 18	Kitovi	trawl	s	blue	vt	360		
33	" 18	Zoltoi Sands	trawl	m	green	t	0	20.0cm	3.0mm
36	" 19	Gorbatch	trawl	m	grey	t	0	23.0cm	4.0mm
43	" 19	Gorbatch	trawl	l	green	t	0		
47	" 20	Vostochni	trawl	l	green	t	0	22.0cm	5.0mm
49	" 20	Vostochni	trawl	m	green	vt	0	21.5cm	3.0mm
51	" 20	Morjovi	trawl	m	white	vt	0	20.0cm	4.0mm
53	" 20	Vostochni	packing band	s	green	vt	360		
56	" 20	Vostochni	packing band	s	green	vt	360		
61	" 21	Zapadni	chord	s	white	vt	360		3.5mm
62	" 21	Zapadni	trawl	m	white	t	0	20.0cm	4.0mm
65	" 22	Polovina	trawl	s	blue	t	30	20.0cm	3.0mm
66	" 22	Polovina	trawl	m	white	t	0	21.0cm	5.5mm
71	" 23	Vostochni	twine	s	white	vt	270		
74	" 24	Zapadni Reef	packing band	s	green	t	0		
79	" 25	Tolstoi	synth. twine	s	white	vt	240		
82	" 25	Tolstoi	twine	s	white	t	360		
85	" 25	Zapadni Reef	trawl	s	grey	t	360		
88	" 26	Kitovi	twine	s	green	t	180		
89	" 26	Kitovi	string	s	white	t	270		
96	" 26	Morjovi	trawl	l	grey	vt	0	19.0cm	3.5mm
97	" 26	Morjovi	packing band	s	yellow	l	0		
100	" 26	Reef	thread	s	white	t	360		
103	" 26	Reef	trawl	l	grey	vt	0		
110	" 28	Polovina	trawl	s	grey	vt	360	20.0cm	5.0mm
111	" 29	Morjovi	trawl	s	green	t	360		
114	" 29	Morjovi	packing band	s	green	l	0		
117	" 29	Vostochni	trawl	l	green	t	0	27.0cm	3.5mm
118	" 29	Vostochni	packing band	s	yellow	vt	360		
123	" 29	Vostochni	packing band	s	yellow	t	100		
126	" 29	Vostochni	trawl	m	blue	t	0	20.0cm	4.5mm
129	" 29	Vostochni	hemp line	s	brown	vt	60		~6mm

Table 4. (continued)

Tag Number	Date	Location	Description of Debris						
			Type	Size	Color	Tightness	Wound	Mesh Size	Twine Size
134	" 29	Vostochni	fish net	s	yellow	vt	360	19.0cm	1.2mm
136[1]	" 29	Vostochni	packing band	s	clear	t	0		
138	" 30	Zapadni	mixed	l	mixed	t	360	24.5cm	2.0mm
139	" 30	Zapadni	trawl	s	green	t	15	24.0cm	3.5mm
144	" 30	Zapadni	trawl	i	white	t	0	20.5cm	2.5mm
147	" 31	Tolstoi	trawl	s	yellow	t	0	20.0cm	4.0mm
150	" 31	Tolstoi	chord	s	green	vt	360		
151	" 31	Tolstoi	trawl	s	grey	t	360		
156	" 31	Kitovi	chord	s	unknown	vt	360		~.6cm
157	" 31	Kitovi	chord	s	green	vt	360		~.6cm
160	" 31	Gorbatch	packing band	s	yellow	t	0		

[1]The right flipper of this animal has tag number 135 on the bottom side.

Table 5. Composition of the debris found on fur seals in 1988 compared to six earlier years and data for the same comparison regarding the entanglement rate (percent of juvenile male seals entangled by debris category).

Type of Debris	Percent of Debris		Entanglement Rate (%)	
	1981-1986	1988	1981-1986	1988
Trawl net fragments	65.2	50.9	0.27	0.15
Monofilament net fragments	2.1	0.0	0.00	0.00
Plastic packing bands	18.1	26.4	0.08	0.07
Chord, rope, string	11.0	18.9	0.05	0.05
Miscellaneous items	3.5	3.8	0.01	0.01
Total	100.0	100.0	0.41	0.28

Table 6. Comparison of numbers and percentages of tags applied and resighted by year for entangled and unenetangled seals. Numbers in parentheses are those applied; numbers in brackets are the percent resighted.

Controls (Unentangled)	Year			
	1985	1986	1987	1988
	(172)	37	-	13
		[21.5]	-	[7.6]
		(279)	-	40
			-	[14.3]
			-	-
			-	-
				(104)

Entangled	Year			
	1985	1986	1987	1988
	(85)	12	-	1
		[14.1]	-	[1.2]
		(128)	-	6
			-	[4.7]
			-	-
			-	-
				(52)